

Alert	Prescribe as noradrenaline base. Noradrenaline acid tartrate 2 mg/mL is equivalent to noradrenaline base 1 mg/mL (1:1,000)												
Indication	Treatment of hyperdynamic shock secondary to sepsis. [1] Second line inotrope for treatment of fluid-refractory hypotensive shock in the setting of low systemic vascular resistance (SVR).[1] Circulatory failure in the setting of pulmonary hypertension refractory to nitric oxide.[2]												
Action	Catecholamine with strong vascular alpha and cardiac beta-adrenergic action, moderate cardiac alpha-adrenergic actions.[3] Noradrenaline increases blood pressure, urine output and reduces lactate in newborns with septic shock refractory to volume expansion and other inotropes.[4] Noradrenaline increases systemic and pulmonary pressures, increases pulmonary blood flow and improves systemic oxygen saturation in newborn infants with pulmonary hypertension and circulatory failure. [2]												
Drug Type	Inotrope and vasopressor.												
Trade Name	Hospira Levophed Noradrenaline 1:1,000, Noradrenaline BNM 1:1000, Noradrenaline MYX 1:1000. All contain Noradrenaline acid tartrate.												
Presentation	Noradrenaline acid tartrate 8 mg/4 mL is equivalent to noradrenaline base 4 mg/4 mL (1:1000)												
Dosage / Interval	Low dose: 0.05–0.1 microgram/kg/minute High dose: 0.2–1.0 microgram/kg/minute												
Route	Continuous IV infusion.												
Preparation/Dilution	<p>LOW CONCENTRATION IV infusion (for >=1kg)</p> <table border="1"> <thead> <tr> <th>Infusion dose</th> <th>Prescribed amount</th> </tr> </thead> <tbody> <tr> <td>1 mL/hour = 0.05 microgram/kg/minute</td> <td>150 microgram/kg noradrenaline base and make up to 50 mL</td> </tr> </tbody> </table> <p>Draw up 150 micrograms/kg (0.15 mL/kg) with 5% glucose or sodium chloride 0.9%⁶ to make a 50 mL solution [i.e., 3 micrograms/kg/mL]. Infusing at a rate of 1 mL / hour = 0.05 microgram/kg/minute.</p> <p>HIGH CONCENTRATION IV infusion</p> <table border="1"> <thead> <tr> <th>Infusion dose</th> <th>Prescribed amount</th> </tr> </thead> <tbody> <tr> <td>1 mL/hour = 0.2 microgram/kg/minute</td> <td>600 microgram/kg noradrenaline base and make up to 50 mL</td> </tr> </tbody> </table> <p>Draw up 600 micrograms/kg (0.6 mL/kg) with 5% glucose or sodium chloride 0.9%⁶ to make a 50 mL solution [i.e., 12 micrograms/kg/mL]. Infusing at a rate of 1 mL / hour = 0.2 microgram/kg/minute.</p> <p>For infants requiring fluid restriction consider: VERY HIGH CONCENTRATION continuous IV infusion</p> <table border="1"> <thead> <tr> <th>Infusion dose</th> <th>Prescribed amount</th> </tr> </thead> <tbody> <tr> <td>1 mL/hour = 0.4 microgram/kg/minute</td> <td>1,200 microgram/kg noradrenaline base and make up to 50 mL</td> </tr> </tbody> </table> <p>Draw up 1,200 microgram/kg (1.2 mL/kg) with 5% glucose or sodium chloride 0.9%⁶ to make a 50 mL solution [i.e., 24 micrograms/kg/mL]. Infusing at a rate of 1 mL / hour = 0.4 microgram/kg/minute.</p>	Infusion dose	Prescribed amount	1 mL/hour = 0.05 microgram/kg/minute	150 microgram/kg noradrenaline base and make up to 50 mL	Infusion dose	Prescribed amount	1 mL/hour = 0.2 microgram/kg/minute	600 microgram/kg noradrenaline base and make up to 50 mL	Infusion dose	Prescribed amount	1 mL/hour = 0.4 microgram/kg/minute	1,200 microgram/kg noradrenaline base and make up to 50 mL
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Administration	Noradrenaline should be given via a central venous catheter (UVC or PICC) using a continuous infusion. Infuse through a dedicated line where possible.												
Monitoring	Continuous heart rate, ECG and blood pressure. Assess urine output and peripheral perfusion frequently. Observe IV site closely for blanching and extravasation.												
Contraindications	Infants with hypovolaemia until blood volume replaced - may cause severe peripheral and visceral vasoconstriction. Infants with mesenteric or peripheral thrombosis. Known hypersensitivity to sodium metabisulfite.												
Precautions	Thyrotoxicosis – may cause severe hypertension.												

	<p>Ensure adequate circulating blood volume prior to commencement. Avoid in hypertension. Overdosage may result in severe hypertension, reflex bradycardia, marked increase in peripheral resistance and decreased cardiac output. The infusion site should be checked frequently for free flow. Care should be taken to avoid extravasation into the tissues which may cause local necrosis. Do not cease infusion abruptly.</p>
Drug Interactions	<p>Should be given with close monitoring to patients exposed to monoamine oxidase inhibitors because severe, prolonged hypertension may result.</p>
Adverse Reactions	<p>Systemic hypertension especially at higher doses. Reflex bradycardia and arrhythmia. Tissue necrosis at infusion site with extravasation. [see special comments] Renal and digital ischaemia may occur. Prolonged administration of any potent vasopressor may result in plasma volume depletion which should be continuously corrected by appropriate fluid and electrolyte replacement therapy.</p>
Compatibility	<p>Fluids: Glucose 5%, sodium chloride 0.9% with glucose 5%, sodium chloride 0.9%, lactated Ringer's solution.</p> <p>Y-site: Amiodarone, anidulafungin, bivalirudin, caspofungin, ceftaroline fosamil, cisatracurium-dexmedetomidine, dobutamine, dopamine, doripenem, esmolol, ethanol, haloperidol lactate, heparin sodium, hydrocortisone sodium succinate, labetalol, midazolam, milrinone, morphine sulfate, mycophenolate mofetil, potassium chloride, remifentanyl, sodium nitroprusside, tigecycline.</p>
Incompatibility	<p>Fluids: No information. 10% Dextrose not tested.</p> <p>Y-site: aminophylline, azathioprine, benzylpenicillin, folic acid, foscarnet, ganciclovir, indomethacin, insulin (short-acting), iron salts, phenobarbitone, sodium bicarbonate, thiopentone. Incompatible with alkalis and oxidising agents.</p> <p>No information: Adrenaline HCL is compatible with noradrenaline bitartrate but no stability data is available for Adrenaline acid tartrate and noradrenaline acid tartrate.</p>
Stability	<p>Diluted solution stable for 24 hours.</p>
Storage	<p>Ampoule: Store below 25°C. Protect from light. Discard unused portion. Do not freeze.</p>
Special Comments	<p>Do not administer with blood products. Glucose solutions (10%, 5%) are protective against the oxidation of noradrenaline. Discard if exhibiting colour change (oxidation). The antidote for extravasation ischaemia is phentolamine. Phentolamine is only available via the Special Access Scheme.</p>
Evidence summary	<p>Efficacy: There are no comparative trials comparing noradrenaline to other vasopressors in newborn infants. Noradrenaline was equivalent to other vasopressors in patients with hypotensive shock (newborns excluded), and resulted in less arrhythmia than dopamine. [5] (LOE I, GOR B)</p> <p>Newborns with septic shock: Noradrenaline 0.2–0.5 microgram/kg/minute increased blood pressure, urine output and reduced lactate in newborns with septic shock refractory to volume expansion and dopamine/dobutamine. [4] (LOE IV, GOR C)</p> <p>Newborns with PPHN and circulatory failure refractory to fluid resuscitation: Noradrenaline 0.5–1.0 microgram/kg/minute improved lung function in newborn infants with PPHN through a decrease in pulmonary/systemic artery pressure ratio and improved cardiac performance[2] (LOE IV, GOR C).</p> <p>Summary:</p> <p>Safety: In non-newborn patients, noradrenaline is associated with less arrhythmia compared to patients treated with dopamine. Overdose may result in severe hypertension, reflex bradycardia, marked increase in peripheral resistance and decreased cardiac output. There are no reports of noradrenaline use in very preterm infants.</p> <p>Pharmacokinetics: The onset of action is rapid after intravenous infusion. The half-life of intravenous noradrenaline has not been reported in sick newborn infants.</p>

References	<ol style="list-style-type: none"> 1. Brierley J, Carcillo JA, Choong K, Cornell T, Decaen A, Deymann A, Doctor A, Davis A, Duff J, Dugas MA, Duncan A, Evans B, Feldman J, Felmet K, Fisher G, Frankel L, Jeffries H, Greenwald B, Gutierrez J, Hall M, Han YY, Hanson J, Hazelzet J, Hernan L, Kiff J, Kissoon N, Kon A, Irazuzta J, Lin J, Lorts A, Mariscalco M, Mehta R, Nadel S, Nguyen T, Nicholson C, Peters M, Okhuysen-Cawley R, Poulton T, Relves M, Rodriguez A, Rozenfeld R, Schnitzler E, Shanley T, Kache S, Skippen P, Torres A, von Dessauer B, Weingarten J, Yeh T, Zaritsky A, Stojadinovic B, Zimmerman J, Zuckerberg A. Clinical practice parameters for hemodynamic support of pediatric and neonatal septic shock: 2007 update from the American College of Critical Care Medicine. <i>Crit Care Med.</i> 2009;37:666-88. 2. Tourneux P, Rakza T, Bouissou A, Krim G, Storme L. Pulmonary circulatory effects of norepinephrine in newborn infants with persistent pulmonary hypertension. <i>The Journal of pediatrics.</i> 2008;153:345-9. 3. Noori S, Seri I. Neonatal blood pressure support: the use of inotropes, lusitropes, and other vasopressor agents. <i>Clinics in perinatology.</i> 2012;39:221-38. 4. Tourneux P, Rakza T, Abazine A, Krim G, Storme L. Noradrenaline for management of septic shock refractory to fluid loading and dopamine or dobutamine in full-term newborn infants. <i>Acta paediatrica.</i> 2008;97:177-80. 5. Havel C, Arrich J, Losert H, Gamper G, Mullner M, Herkner H. Vasopressors for hypotensive shock. <i>The Cochrane database of systematic reviews.</i> 2011:CD003709. 6. Micromedex online. Accessed on 23 February 2017.
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Authors Contribution

Original author	David Osborn
Expert review	David Schell, Hari Ravindranathan
Evidence Review	David Osborn
Nursing Review	Eszter Jozsa
Pharmacy Review	Jing Xiao, Mariella De Rosa, Ushma Trivedi, Cindy Chen
Final content and editing review of the original	Ian Whyte
Electronic version	Mariella De Rosa, Cindy Chen, Ian Callander
Facilitator	Srinivas Bolisetty